Satellite Altimetry for a Global Ocean Observing System

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Space-age technologies have made satellite remote sensing a powerful new tool to study the Earth on a global scale. However, the opacity of the ocean to electromagnetic sensing has limited spaceborne measurements to the properties of the surface layer of the ocean (such as sea surface temperature and color). The radar atlimetric measurement of the height of the sea surface relative to the geoid, the dynamic topography of the ocean, is a very useful quantity for studying the circulation of the ocean. The ability of measuring dynamic topography from space makes satellite altimetry a uniquely useful remote sensing technique because dynamic topography reflects oceanic processes not only at the surface but at depths as well. A simple analysis shows that a one centimeter tilt in the dynamic topography is associated with a mass transport of 1-7 Sv (1Sv= 1 million tons per second) in the open ocean depending on the vertical distribution of current velocity. Such a magnitude is an appreciable fraction of the transport of the Florida Current (circa 30 Sv), for instance. TOPEX/POSEIDON has demonstrated the capability of measuring the time variation of sea level with accuracy approaching to 2 cm when the data are averaged over boxes with several hundred kilometers on each side. The data set has been used for studying ocean circulation phenomena with a wide range of scales, ranging from fast-changing barotropic variability to seasonal and interannaul variability such as El Nino and La Nina. The long record of precise measurement of global sea level has also showed great promise for monitoring the variation of mean sea level, an effective indicator of global climate change. Continuation of satellite altimetry missions with capability matching or better than that of TOPEX/POSEIDON should be included as a key component of a Global Ocean Observing System. NASA and CNES have committed to continuing the measurement of TOPEX/POSEIDON with a series of follow-on missions called Jason. The first of the series, Jason-1, is scheduled for launch in May, 2000. Such a series of missions will provide a key data stream for both research and practical applications and benefit the objectives of global programs such as CLIVAR and GODAE.